

Digestion: Summary of Nutrients & Digestion of Nutrients

Summary of macronutrients:

	Carbohydrates	Proteins	Lipids
Chemical structure:	<ul style="list-style-type: none"> -<u>monosaccharides</u> (single sugars), e.g., glucose, fructose -<u>disaccharides</u> (double sugars), e.g., sucrose, maltose, lactose -<u>polysaccharides</u> (long chain sugars), e.g., starch, cellulose (plant fibres) 	<ul style="list-style-type: none"> -long chains of <u>amino acids</u> that are highly variable in length and shape -20 amino acids in total, 8 are <u>essential</u> (i.e. cannot be produced by the body & must be consumed in food) 	<ul style="list-style-type: none"> -fats & oils are triglycerides (made of glycerol + 3 fatty acid chains) -fatty acids can be saturated (usually solid at room temperature, e.g., meat fats, butter) or unsaturated (usually liquid at room temperature (e.g., vegetable oils) -essential fatty acids are unsaturated & cannot be produced by the body (e.g., omega-3 fatty acids)
What does the body use them for?	<ul style="list-style-type: none"> -main source of energy 	<ul style="list-style-type: none"> -key building blocks of cell structures -perform a wide range of functions -form some hormones -used to generate motion, etc. 	<ul style="list-style-type: none"> -energy storage -form cell membranes -insulate organs -form some hormones
How much?	<ul style="list-style-type: none"> -recommended to provide at least 55% of calories -are stored in liver & muscles as glycogen; excess sugars are stored as fat 	<ul style="list-style-type: none"> -recommended 10-30% of calories from protein 	<ul style="list-style-type: none"> -recommended no more than 30% of calories come from lipids -excess consumption can lead to heart disease & obesity -"good" & "bad" cholesterol -trans fats are hydrogenated unsaturated fats, but behave like saturated fats & raise bad cholesterol levels

(Other nutrients include water, vitamins, minerals.)

How does your body physically & chemically digest these nutrients?

	Carbohydrates	Proteins	Lipids
mouth	-physical digestion of all food types by teeth -saliva dissolves food so that it can be tasted -mucus lubricates food & aids swallowing of bolus		
	-salivary amylase starts to digest starch into disaccharides (chemical digestion)		
stomach	-when food enters the stomach, <i>submucosa</i> cells release hormone gastrin -gastrin stimulates <i>mucosa</i> cells to release gastric juice (mucus, hydrochloric acid, digestive enzymes such as pepsinogen) -acid (pH around 2.5) kills harmful bacteria -nerves signal muscular layer of stomach, <i>muscularis</i> , to contract, churning & mixing the food with the gastric juices, turning it into chyme		
	-salivary amylase is deactivated by low pH	-HCl converts pepsinogen to its active form (pepsin) -pepsin starts breaking down proteins into amino acids	
small intestines (mostly the duodenum)	-pyloric sphincter periodically relaxes, letting small amounts of chyme to enter the duodenum -chyme causes release of hormone cholecystokinin (CCK) by <i>mucosa</i> cells in duodenum -CCK stimulates pancreas to release various enzymes through the pancreatic duct into the duodenum -CCK signals to the stomach to slow down digestion -acidic chyme causes conversion of prosecretin in epithelial cells to secretin , which: -stimulates liver to make more bile -stimulates pancreas to release enzymes & bicarbonate ions (HCO_3^-), which raise the pH to 9.0 -signals stomach to slow down release of chyme into duodenum -presence of lipids in chyme causes gall bladder to contract, releasing bile through the bile duct into the duodenum		
	-pancreatic amylase continues breakdown of starch into di- and monosaccharides	-pepsin is inactivated by pH 9.0 -trypsinogen (from the pancreas) is converted to trypsin by enzyme enterokinase ; trypsin further breaks down proteins -carboxypeptidase & erepsins break down short proteins into individual amino acids	-bile emulsifies fat into smaller droplets (physical digestion) -lipases (from the pancreas) break lipid chains into shorter chains & individual fatty acid molecules

